THE HUNTER DRAIN
STILLWATER NATIONAL WILDLIFE REFUGE
FALLON, NEVADA

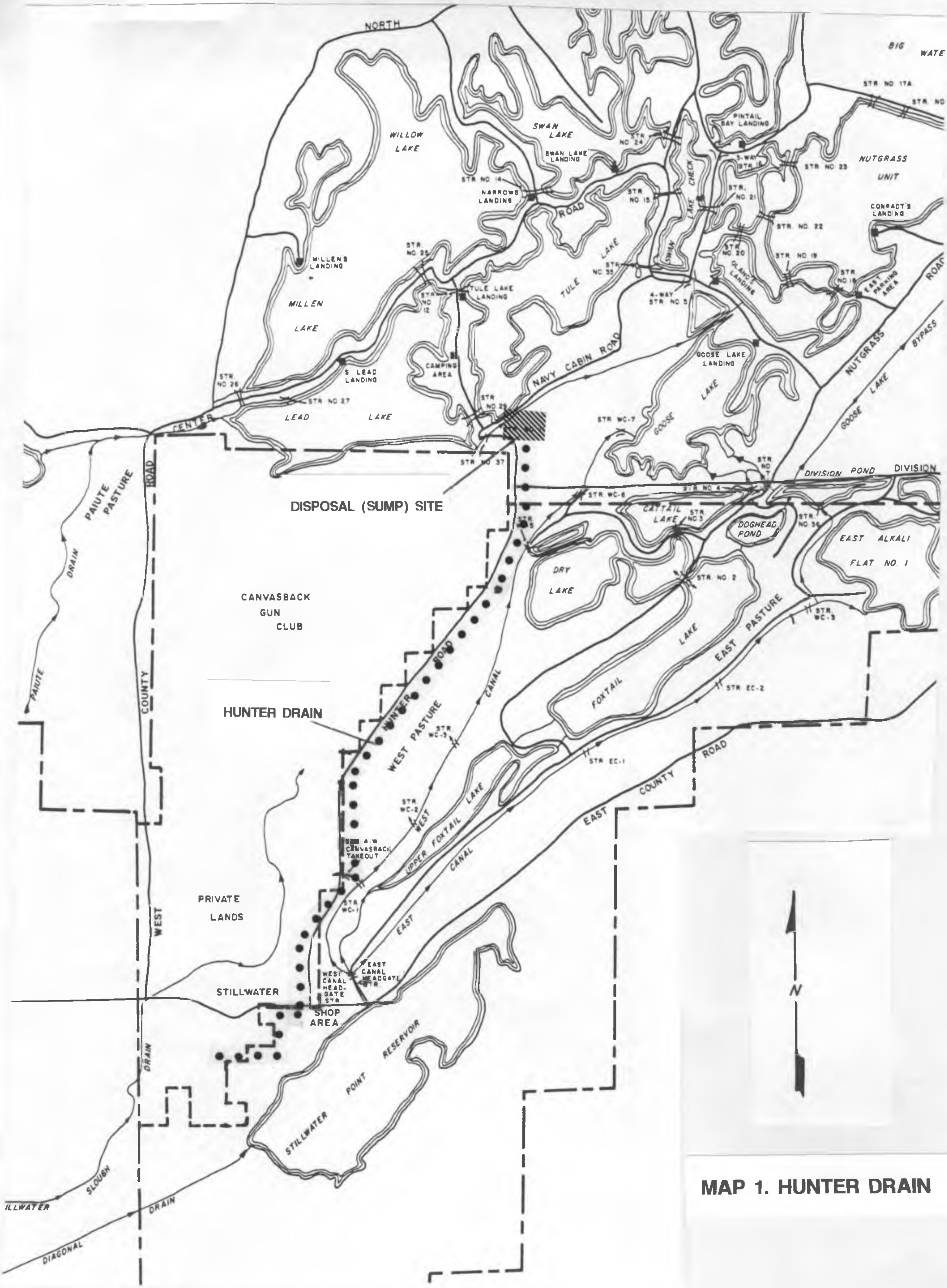
THE HUNTER DRAIN

THE PROBLEM:

Hunter Drain was constructed by Truckee Carson Irrigation District (TCID) and Bureau of Reclamation (BOR) in the 1940's to provide surface and subsurface drainage in the vicinity of the Stillwater Point Reservoir on the Stillwater National Wildlife Refuge (SNWR). In the early 1950's, the drain was deepened and lengthened by the U.S. Fish and Wildlife Service (FWS) at the request of TCID. The Hunter Drain flows northward approximately 8 miles from near Stillwater Point Reservoir eventually discharging into an evaporative pond, the Hunter Drain Sump (Map 1). The Drain was constructed at the request of the Kent Family (adjacent property owner to SNWR) as a means of alleviating a rising water table under 180 acres of the family's agricultural fields. The Kent's contend that the hydrostatic pressure in the groundwater resulting from the storage of water in the Stillwater Point Reservoir, which is 5 feet higher in elevation than the Kent's fields, causes the rise in the water table on their lands.

Water quality surveys conducted in the mid-1980's found evidence of water quality problems and toxic conditions in the Hunter Drain. The Service in response to these water quality surveys, restricted the discharge of the Hunter Drain to the sump as a short term solution to prevent Hunter Drain flows from entering the main marsh. The sump is located south of Tule Lake and is only intermittently ponded to various shallow depths but on average is approximately 25 acres in size. In response to documented toxic problems, the Hunter Drain Sump is an evaporation pond similar to those in the Tulare Basin, California. Migratory birds have frequently been observed feeding and resting in the sump area. Potential impacts of the sump on wildlife have not been fully evaluated.

Although this drain contributed less then 1% of the total flows to the SNWR (Table 1), return flows or drainwater from the Kent property probably account for as much as 50% of the total average annual flow in Hunter Drain. This is based on a 630 acre feet (3.5 ac.ft. per acre) head gate entitlement for the irrigated farmland of the Kent's. Approximately 538 acre-feet are consumptively used by agriculture (2.99 ac.ft. per acre is the consumptive rate for alfalfa). In theory this would result in the loss of approximately 92 acre-feet of water to the shallow aquifer. It is assumed that these irrigation losses reach Hunter Drain. While this drainwater accounts for a very small percentage of inflow to the Stillwater marshes the water quality of the Hunter Drain has been shown to be toxic to particular forms of aquatic life and most probably hazardous to migratory birds and other wildlife.



MAP 1. HUNTER DRAIN

Table 1. Summary statistics for streamflow, (total) dissolved solids (TDS), and dissolved-solids load (in tons per day) for principal inflows (directly and indirectly) to Stillwater WMA wetlands, 1979-89. Measurements are instantaneous. (Number in parenthesis indicates percentage of total for 1986-1989 data set only). This information is generated from data in Rowe and others, 1991.

Station	Year	Streamflow, in cuft/Sec	TDS, in mg/L	TDS Load in tons/day
Paiute Div. Drain At Wildlife Ent.	1986-89	11.0 (18%)	438	14 (11.5%)
T-J Drain	1986-89 (a) 1989	0.7 (1%) 1.0	7,190 6,300	17 (14.0%) 17
Stillwater Pt. Div (Diagonal Drain)	1986-89	35.0 (57%)	794	53 (43.0%)
Stillwater Slough	(b) 1986-89	14.5 (24%)	781	28 (23.0%)
Hunter Drain	1987-89	0.2 (<1%)	46,380	10 (8.2%)

(a) Water samples collected over 24-hr periods from May to November 1989 during irrigation season only.

(b) Stillwater Slough flows into Stillwater Farms, and subsequently then, with unknown quantity and quality, into the refuge.

TOXICOLOGICAL INVESTIGATIONS:

Surface water, sediment and biota from Hunter Drain and Hunter Drain Sump have been sampled and analyzed for salinity, trace elements and toxicity during various studies since 1986. The findings of toxicological investigations indicate that significant concentrations of selenium, boron, lithium, molybdenum and arsenic were found in Hunter Drain. Although no individual contaminant was detected at acutely toxic concentrations, a strong relationship was defined between combined presence of 4 elements (arsenic, lthium, boron, molybdenum) and various test organisms. The most toxic water in Hunter drain ocurred as seepage from groundwater; Increased flows in the drain during irrigation was responsible for reduction of salinities and conductivity. A summary of results of specific toxicological investigations are listed in Appendix 1.

SOLUTIONS

Close Hunter Drain

The Service needs to eliminate the subsurface drainage into the Hunter Drain and sump. The most direct coarse of action for the Service would be to close the Hunter Drain, thereby eliminating the surface discharge of these poor quality drainwaters unto the Refuge.

The Refuge staff has determined that the drain can be closed by backfilling. Backfilling the drain would require 300,000 cubic yards of material based on calculations that the drain is approximately 8 miles long, 15 feet wide and 7 feet deep. It is estimated that it would take at least two months to complete. Before work begins, the location and type of structures or material to stop preferential ground water flow will need to be determined. These structures would need to be placed in the drain while the backfilling occurs. The estimated cost to install the structures and backfill the drain is $150,000 to $200,000.

The Hunter Drain has been determined to be non-jurisdictional under Section 404 of the Clean Water Act (Kevin Roukey, oral commun.). Therefore filling of Hunter Drain does not require any special permits in compliance with this act.

Consequences of Drain Closure

Since there is little scientific information on the shallow acquifer in this area, particularily related to the direction of flow and gradient, it is difficult to determine if the subsurface drainwater will surface in another area on the Refuge or adjacent lands if Hunter Drain is backfilled.

The Kent family contends that the closure of Hunter Drain and the continued operation of Stillwater Point Reservoir as a storage reservoir will cause their irrigated farmland to become water-logged and unuseable. This is based on their contention that there is a subsurface flow gradient of reservoir seepage from Stillwater Point Reservoir west towards their irrigated farmlands. In the USGS groundwater study, "Geohydrology of the Basalt and Unconsolidated Sedimentary Aquifers in the Fallon Area, Churchill County, Nevada" (Glancy, 1986), the shallow aquifer gradient is northeastward and eastward toward Carson Sink and Stillwater Lakes, completely opposite to the gradient postulated by the Kent's. The Service can only speculate that the shallow aquifer defined in the Glancy report is essentially the same groundwater aquifer which effects the Kent properties and discharges into Hunter Drain.

<u>OPTIONS to Alleviate Consequences</u>

Purchase Adjacent Lands

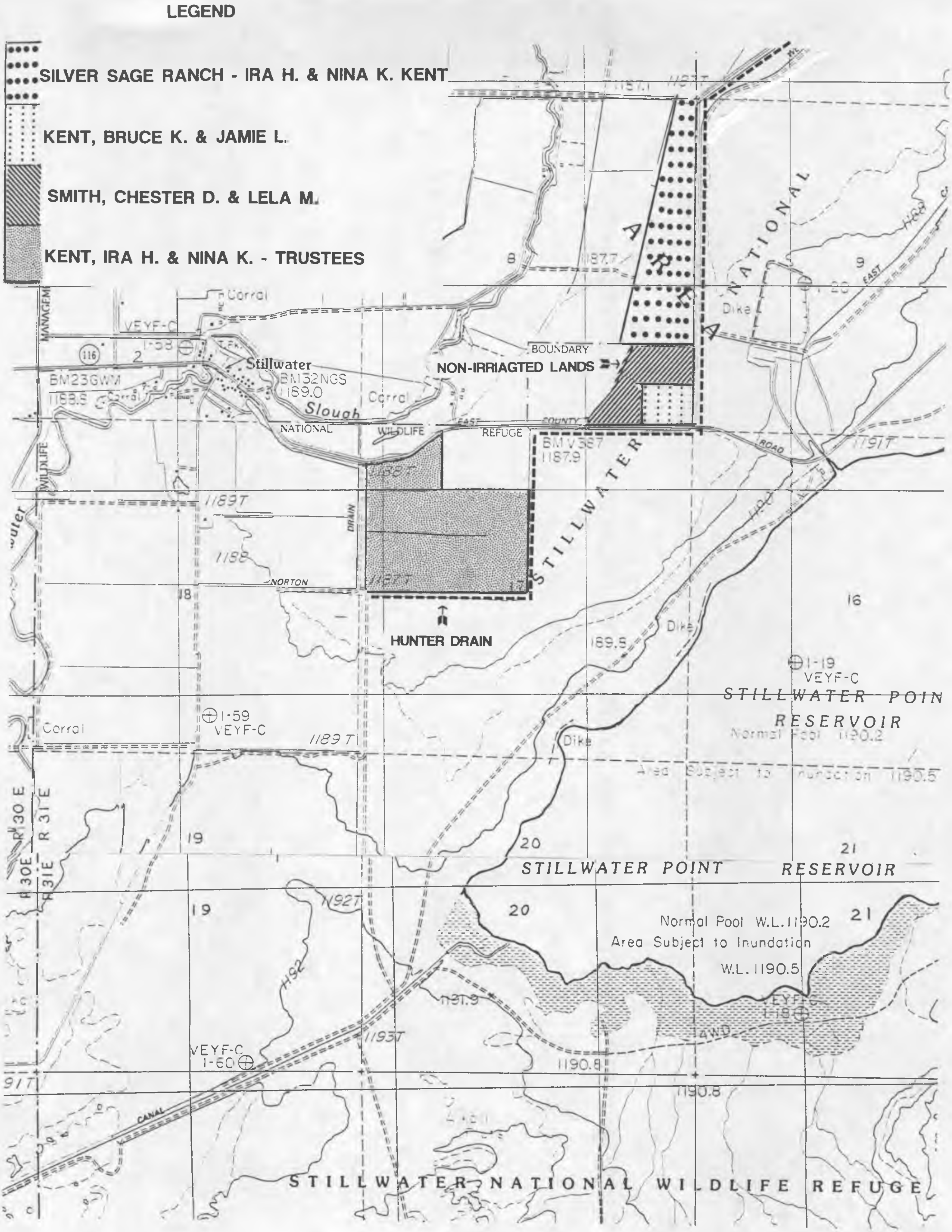
In order to alleviate any possible problems which could arise if Hunter Drain is closed, the preferred option of the Service is to purchase the farmland adjacent to the Hunter Drain (Map 2) and retire those lands from agricultural use. This would provide a two-fold advantage, one in eliminating a source of drainwater and two in providing mitigation to the owners of the property if in fact it can be proven that the water table rose on account of the drain closure and the farmland became water logged. Since these farmlands are within the Stillwater NWR boundary they could be purchased as part of the Water Rights Acquisition Program under P.L. 101-618 and the water rights transferred to the wetlands.

In January 1989 and January 1992, the USFWS Realty Division contacted Mr. Bruce Kent to pursue the purchase of Kent lands adjacent to Hunter Drain. In September 1990, Dave Livermore of the Nature Conservancy also approached Mr. Kent for a land purchase. Mr. Kent declined all three of the attempts to discuss purchase offers. (Appendix 2). Unless new negotiations with Mr. Kent are undertaken and progress is made on a willing seller basis, the Service will need to address other options.

Abandon Stillwater Point Reservoir

Terminating the use of Stillwater Point Reservoir as a storage reservoir would require the construction of a canal to facilitate the delivery of Diagonal drainwater to Stillwater Farms and Stillwater NWR. Water storage for the Refuge would then be maintained in units down gradient. These units are: Upper and Lower Foxtail, Dry, East Alkali and Cattail lakes.

One solution would be to dig a canal through the bottom of the reservoir and pass water directly through it. This was attempted during the last drought (late 1970's) when a canal was dug to



MAP 2. AFFECTED LANDS

increase efficiency. This canal has now silted in and is no longer useable.

The preferred solution would be to dig a bypass canal. The proposal for construction of a bypass delivery canal around Stillwater Point Reservoir are attached (Appendix 3). A canal approximately 12,500 feet in length would need to be dug and a water control structure installed with the preferred route connecting the Diagonal Drain located west of the reservoir to water control structure #1 (Map 3). This work would require surveying and engineering to develop the most efficient route. A turnout to the reservoir at this new structure would be needed to contain and clean-up any emergency releases (flood waters, jet fuel spills on the Navy Base or possible discharges from the Fallon sewage treatment plant) which are discharged into drainage canals.

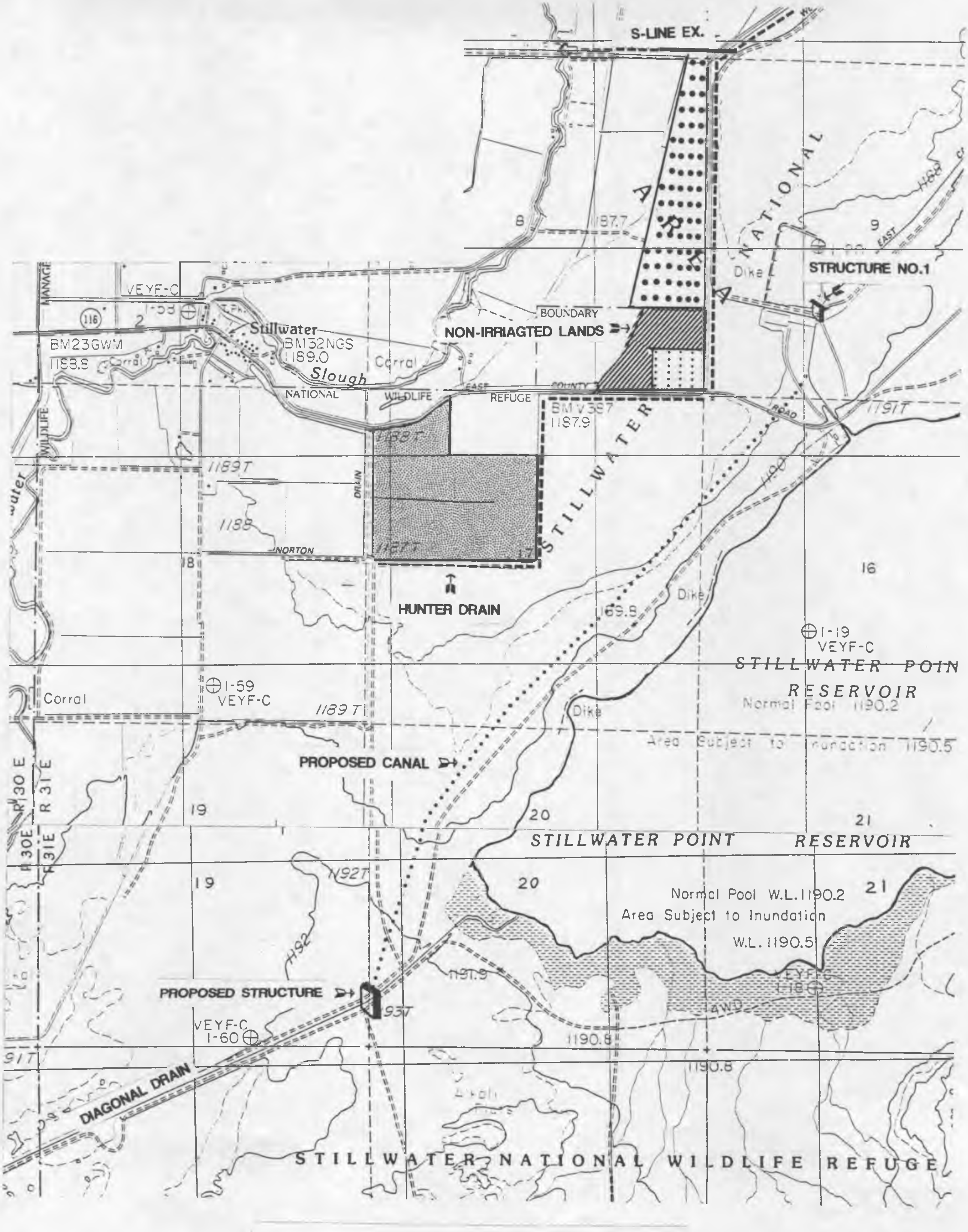
It is estimated that the new canal and structure could be built at an estimated cost of 200,000 to 300,000. Once the work is commenced it could probably be completed in two months.

Consequences of Abandoning Stillwater Point Reservoir

Presently, TCID delivers water (primarily return flows) via Diagonal Drain to the reservoir where it is stored and available when called for by Stillwater Farms (Canvasback Gun Club). Approximately 50% of the Stillwater Farm's water deliveries are comprised of return flows delivered to the east side of their lands via Stillwater Point Reservoir. If the reservoir is abandoned as a primary storage reservoir, a by-pass canal probably would need to be constructed to allow deliveries from the Diagonal drain to Stillwater Farms and the Refuge. Loss of the reservoir for storage would impact Stillwater Farm's options for water delivery. Stillwater Point Reservoir does provide about 1850 acres of quality wetland habitat that would be lost. It is anticipated that TCID would object to abandoning Stillwater Point Reservoir since they have objected to previous proposals to eliminate the reservoir or to construct a by-pass canal around the reservoir. Additionally, the reservoir does provide an opportunity for the Service to contain potential spills from upgradient sources (Navy Fuel Farm or a Fallon sewage treatment plant) preventing contamination of other Refuge wetland units.

RECOMMENDATION

The Service should close Hunter Drain by backfilling the ditch and terminate use of Stillwater Point reservoir as a primary storage reservoir by constructing a by-pass canal to facilitate delivery of water from the Diagonal Drain to Stillwater Farms and the Refuge. This combination of options would essentially put things back as they were in the late 1930's before the irrigation district and the Kent family sought to alleviate high water table problems on the Kent property. This option would also leave



MAP 3. PROPOSED BY-PASS CANAL

Stillwater Point Reservoir available for emergency storage and could be used some years as a shallow wetland unit. Continued use of Stillwater Point reservoir is consistent with a proposal made by TCID Board members (Appendix 4) where the reservoir would be operated at a reduced capacity (2/3) to alleviate the water table problems (Appendix 5). Without the ability to purchase the Kent property, reduced reliance on Stillwater Point Reservoir for water storage would alleviate the contended effects on the Kent property by the closure of Hunter Drain.

Literature cited.

Hoffman, R.J., R.J. Hallock, T.G. Rowe, M.S. Lico, H.L. Burge, and S.P. Thompson. 1990. Reconnaissance Investigation of Water Quality, Bottom Sediment and Biota Associated with The Irrigation Drainage In and Near Stillwater Wildlife Management Area, Churchill County, Nevada 1986-87. U.S. Geological Survey Water Resource Investigations Report 89-4105. 150 pp.

Finger, S.E., S.J. Olson, and A.C. Livingstone. 1989. On site toxicity of irrigation drainwater from Stillwater National Wildlife Refuge to aquatic organisms. 1988 Progress Report. National Fisheries Contaminant Research Center. U.S. Fish and Wildlife Service. 58 pp.

Rowe, T.G., M.S., Lico, R.J. Hallock, A.S. Maest, and R.J. Hoffman. 1991.
Physical, Chemical, and Biological Data for Detailed Study of Irrigation Drainage In and Near Stillwater, Fernley, and Humboldt Wildlife Management Areas and Carson Lake, West-Central Nevada, 1987-89. U.S. Geological Survey Open File Report 91-185. 199 pp.

Tokunaga, T. and S. Benson. 1991. Evaluation of Management Options for Disposal of Salt and Trace Element Laden Agricultural Drainage Water from the Fallon Indian Reservation, Fallon, Nevada. Lawrence Berkeley Laboratory - Earth Science Division, Final Report October 1, 1989 to December 30, 1990. 165 pp.

APPENDIX 1

Summary of Toxicological Investigations

1) Toxicity of Hunter Drain Water was analyzed by on-site bio-assay tests using full strength drainwater and dilutions at 50%, 25% and 12.5%. The following organisms were used in the tests: bluegill, larval flathead minnow and daphnids for fresh water species, and mysids and larval sheephead minnows for salt water species (Finger et al, 1988).

* No organisms (fresh water or saltwater species) survived exposure to full strength or 50% dilution of drainwater from Hunter Drain.

* Levels of boron, lithium, molybdenum in Hunter Drain were higher then any other location studied at SNWR. Arsenic levels were similar to TJ Drain.

* No individual contaminant was detected at acutely toxic concentrations ... but a strong relationship was defined between combined presence of 4 metals (arsenic, boron, lithium, molybdenum) and the mortalities in the tests. The Hunter (and TJ) Drain consistently had higher levels of these 4 elements then other areas on SNWR.

* Salinities during the study ranged from 0-28% .. higher levels of contaminants corresponded with high levels of salinities.

* Extremely high salinities were measured under conditions of low flow when there was no visible contribution of irrigation water to the drain. During this period seepage from groundwater was evident from the banks of the drain. Increased flows of irrigation water into the drain was responsible for reduction of salinities and conductivity.

2) Trace element concentrations and salinity were measured in water and sediment samples from the Hunter Drain and Hunter Drain Sump (April, May 1990). Sediments from the sump were collected from the surface to .10 meter in depth. Sediment samples were air dried and reconstituted in the laboratory with distilled water to determine the extent trace elements may be recycled between dry sediments and re-ponded surface waters. Such conditions occur during reflooding of dry lake beds. At this time only salinity (EC), Boron and Arsenic data has been reviewed. Other data are still being processed (Tokunaga and Benson, 1991).

* This study detected significant concentrations of Selenium from the drain and sump ranging from 3.5 to as high as 97.0 ug/l which had not been reported in previous studies (Table 2.3).

* Conductivity measurements of water samples from re-ponded sediments indicated Hunter Drain to be the most saline, followed by Pintail Bay, South Lead Lake and South Lead Lake Ditch sediments (Table 5.1 and Figure 5.4).

* Arsenic and Boron concentrations in water samples from re-ponded sediments from the Hunter sump sediments exceeded all other areas (Figure 5.5). The effect level for Boron in surface waters was greatly exceeded in all cases despite ponding with initially clean waters.

3) During drainwater reconnaissance investigations composite samples of brine flies taken from the drain in 1988 contained 5.3, 11.4, 17.9 and 10.8 ug/g dry weight selenium. Dr. Gregory J. Smith (oral communication 1989) has documented both reduced hatching success and weight loss in female mallards with dietary selenium levels of 7.0 ug/g dry weight. Accordingly, the dietary effect levels for birds (7.0 ug/g dry weight) are used as guidelines for interpretation of the insect data. Black-necked stilts have been observed feeding on brine flies found in the drain.

Hunter Drain surface water was sampled only once during this reconnaissance investigation. The highest dissolved-solids concentration (53,000 mg/l) recorded in this study was in a water sample collected from Hunter Drain in July 1987. Water chemistry from this sample suggests that the drain was receiving inflow from seepage of shallow saline gound water rather than from agricultural drain water. For comparison the concentrations of dissolved solids in sea water averages about 35,000 mg/l (Hoffman et al, 1989 p.31).

4) Five samples of surface water, two algae samples and two detritus samples were analyzed for trace elements from Hunter Drain during the detailed studies of irrigation drainwater investigations 1987-1989. The results of the analysis indicate that the total dissolved solids from the drain are quite high and potentially toxic (ranging from 5,270 to 48,400 ug/l) however, no individual element appears to be present at toxic concentrations supporting previous studies (Finger at al 1988). Only arsenic (ranging from 98 to 230 ug/l), boron (ranging from 5,500 to 77,000 ug/l) and molybdenum (ranging from 120 to 2500 ug/l) appear in high concentrations. Selenium in surface water was less then 1 ug/l.

* Two detritus and algae samples were taken from Hunter Drain; Levels of mercury (4.0 and 2.55 ug/g for detritus and 1.07 and 1.3 ug/g for algae) exceeded the concern levels for mercury in the diet of mallards (.39 ug/g).

* One of two algae samples analyzed for boron was at (99 and 68 ug/g) the concern level for boron in the diet of mallard ducklings (100 ug/g).

* Levels of selenium in detritus (.70 and .20 ug/g) and algae (.91 and .40 ug/g) were well below the effect levels for selenium in the diet of fish (5.0 ug/g) and female mallards (7.0 ug/g).

Table 2.3. Hunter Drain and Hunter Drain Sump water quality information. "D" and "S" denote samples collected in various locations in the Drain and Sump respectively. (Tokunaga and Benson, 1991. p.37)

Date	Site	E. C. dS/m	pH	As µg/L	B mg/L	Li mg/L	Mo mg/L	Se µg/L
7/22/89	D	8.1	7.8	68	9.6	na	0.2	45.0
7/22/89	D	16.0	9.0	113	13.1	na	0.7	97.0
4/7/90	D	23.3	8.3	92	27.3	1.1	1.3	8.7
4/7/90	D	26.6	8.2	140	31.7	1.3	1.3	7.4
4/7/90	D	29.7	8.3	142	35.0	1.5	1.5	9.2
4/7/90	D	15.9	8.3	106	18.1	0.8	0.8	5.6
4/8/90	D	87.3	8.6	251	102.0	5.3	1.9	11.7
4/8/90	D	27.5	7.9	173	18.5	1.1	1.0	6.6
4/8/90	D	27.4	8.0	174	18.7	1.1	1.0	4.9
4/8/90	S	64.4	8.2	438	45.9	2.1	1.0	4.3
4/8/90	S	63.2	8.2	412	44.3	2.1	1.0	3.5
5/10/90	D	86.8	8.3	507	61.1	3.0	1.4	7.8
5/10/90	D	87.2	8.3	502	61.2	3.0	1.4	7.7
5/12/90	D	73.5	8.3	377	52.8	2.8	1.3	8.2
5/12/90	S	86.3	8.4	445	64.6	3.0	1.3	6.0
6/13/90	D	101.0	8.0	333	190.0	9.7	3.2	16.2
6/13/90	D	109.0	8.0	376	184.0	10.4	2.8	17.0
6/13/90	D	52.1	8.9	261	45.0	2.0	0.0	7.1
6/13/90	D	51.9	8.9	260	49.0	2.0	1.6	6.1

Table 5.1. Water-extracted concentrations of arsenic, boron, lithium, molybdenum, selenite (Se^4), and total water-extractable selenium in several SWMA sediments. Note that the arsenic and selenium concentrations are in units of µg/(kg soil) or ppb. Details of locations are provided in the text.
(Tokunaga and Benson, 1991 p.148)

Site Name	As µg/kg	B mg/kg	Li mg/kg	Mo mg/kg	Se^{+4} µg/kg	Se µg/kg
South Lead Lake "ditch," sed.-1	284	5.4	3.90	1.5	2.5	6.5
South Lead Lake "ditch," sed.-2	235	4.8	0.50	1.0	2.5	5.5
South Lead Lake Landing sediment 1	402	5.7	1.05	1.9	2.0	4.3
South Lead Lake Landing sediment 2	546	5.9	1.00	2.1	1.6	4.1
East Goose Lake crust	1150	180	1.95	30.5	12.5	128
East Goose Lake crust	995	139	1.40	22.6	6.0	61.0
East Goose Lake crust	990	121	1.65	29.8	6.0	68.0
E Goose Lake sediment, 0.01-.03 m, 1	1450	172	1.55	21.7	6.5	72.0
E Goose Lake sediment, 0.01-.03 m, 2	1270	128	1.35	22.2	5.5	57.0
E Goose Lake sediment, 0.03-.10 m, 1	1590	144	1.15	10.4	2.0	30.0
E Goose Lake sediment, 0.03-.10 m, 2	1610	128	1.25	15.1	2.5	29.0
Pintail Bay Landing, crust 1	407	198	9.95	30.0	27.8	501
Pintail Bay Landing, crust 2	405	180	7.90	21.7	20.8	257
Pintail Bay Landing sed., 0.01-.05 m, 1	838	34.9	2.15	2.6	5.3	37.0
Pintail Bay Landing sed., 0.01-.05 m, 2	870	33.8	2.10	2.6	4.7	37.5
Pintail Bay Landing sed., 0.05-.10 m, 1	1020	19.5	0.80	1.0	3.7	19.1
Pintail Bay Landing sed., 0.05-.10 m, 2	1080	18.5	0.80	0.9	3.3	19.9
Hunter Drain Sump sed., 0-0.10 m, 1	1620	72.1	3.00	5.0	14.2	26.0
Hunter Drain Sump sed., 0-0.10 m, 2	1650	71.7	2.95	4.3	12.2	22.3

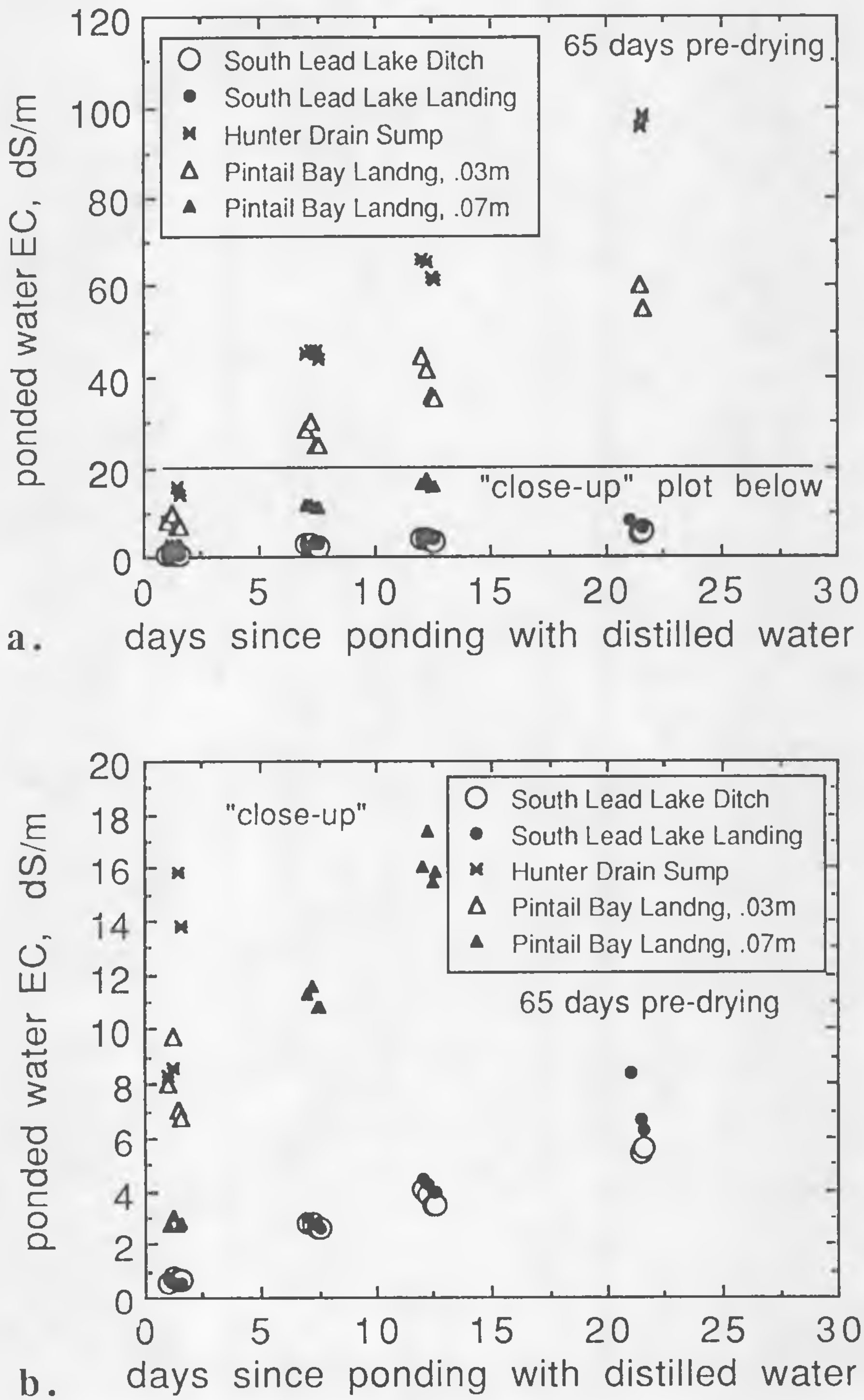


Figure 5.4. (a) Electrical conductivities (EC) of waters ponded over SWMA sediments. The plotted data are linearly normalized to the original sample volume from measurements made on diluted samples. (b) Close-up view of lower EC data. (Tokunaga and Benson,1991 p.152)

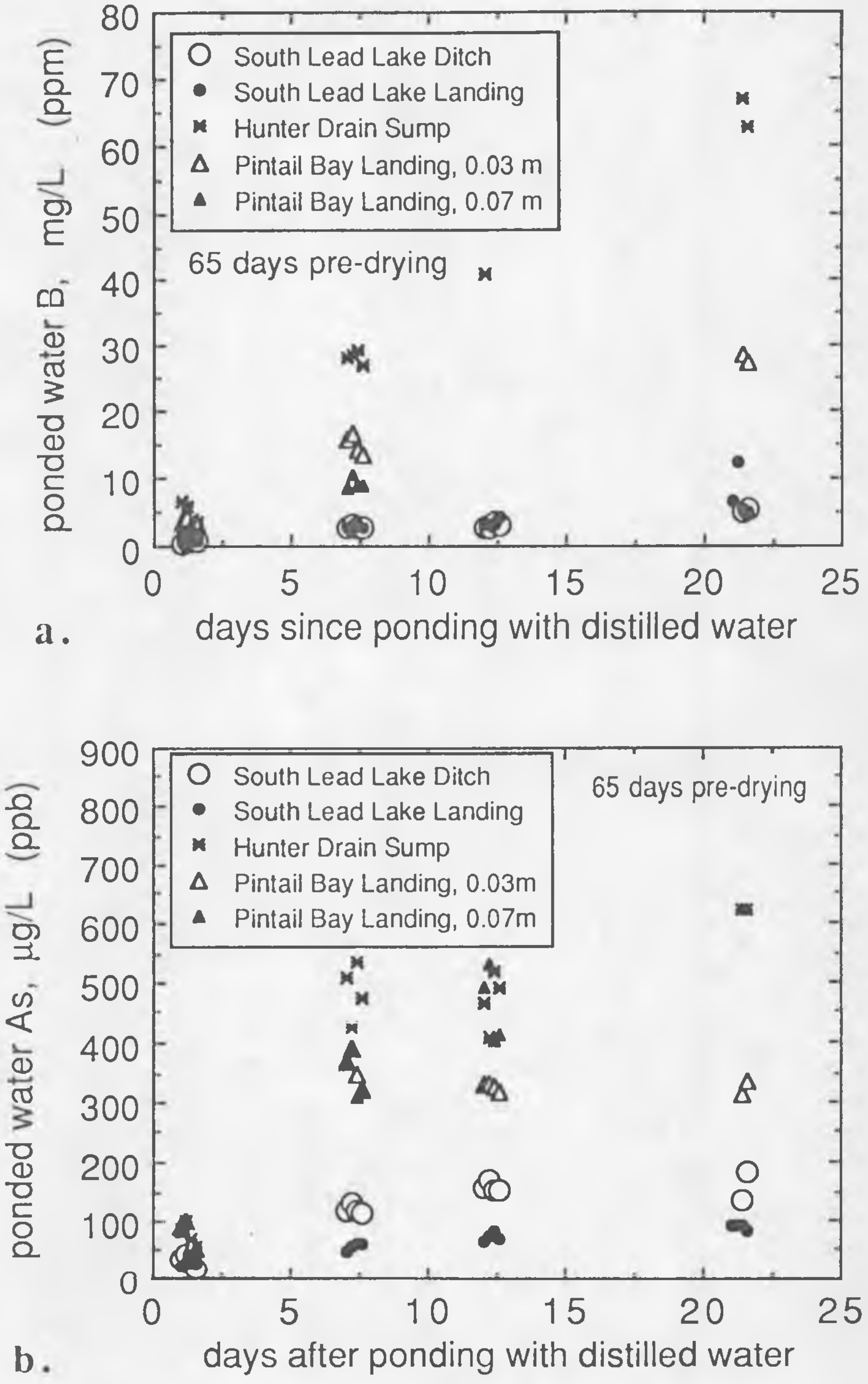


Figure 5.5. (a) Boron concentrations in waters ponded over SWMA sediments. (b) Arsenic concentrations in waters ponded over SWMA sediments.
(Tokunaga and Benson, 1991 p.153)

APPENDIX 2

To: Anne Janik
Refuge Biologist

From: Bob Bryant
Realty Specialist

1/27/89 ------Bruce Kent declined to even have an offer made, this was to me via Telecon

Sept 1990-----Bruce Kent declined to sell to Dave Livermore of TNC. This was before de Braga's protest (by Bruce Kent) hearing on our purchase of de Brag's water.

1/29/92-------Bruce Kent declined via a face to face meeting with me in his home to sell any land. He said now that Stillwater Point Reservoir is lower, there is no drain water in the drain.

APPENDIX 3

North American Wetlands Conservation Council

NAWCC

PROPOSAL APPLICATION COVER PAGE

UNITED STATES PROPOSAL NUMBER______________ DATE RECEIVED____________

PROJECT TITLE Stillwater NWR Bypass Delivery Canal

GRANTEE INFORMATION

ORGANIZATION Stillwater National Wildlife Refuge

CONTACT PERSON Ron Anglin, Bill Henry, Barry Whitehill

ADDRESS P.O. Box 1236

Fallon, Nevada 89406-1236

PHONE NUMBER 702/423-5128 FAX NUMBER 702/423-0416

DATE SUBMITTED June 7, 1991

EXECUTIVE SUMMARY

PROJECT TITLE

LOCATION: Stillwater National Wildlife Refuge

PROJECT GOAL: To provide an efficient water delivery system to the Stillwater National Wildlife Refuge.

GRANTEE ORGANIZATION: U.S. Fish and Wildlife Service

FUNDING HISTORY

NORTH AMERICAN WETLANDS CONSERVATION ACT FUNDS		PARTNER FUNDS			
		U.S. NON-FEDERAL		U.S. FEDERAL	
		CASH	IN-KIND	CASH	IN-KIN
RECEIVED TO DATE	$ 00.00				
FUTURE REQUESTS	$ 00.00				
CURRENT REQUEST	$214,000				
PARTNER 1:		$	$	$	$
PARTNER 2:		$	$	$	$
PARTNER 3:		$	$	$	$
PARTNER 4:		$	$	$	$
PARTNER 5:		$	$	$	$
PARTNER 6:		$	$	$	$
TOTALS	$ 214,000	$		$	

PROJECT DESCRIPTION

PROJECT ELEMENTS		ACRES	DOLLARS
ACQUISITION	FEE		$
	EASEMENT		$
	LEASE		$
ENHANCEMENT			$ 214,000.00
RESTORATION			$
OTHER:			$
TOTALS			$ 214,000.00

CURRENT AND FUTURE TITLE HOLDER AND MANAGER: U.S. Government, U.S. Fish and Wildlife Service.

PUBLIC ACCESS: Yes

WETLANDS VALUES: High

SPECIAL CONSIDERATIONS: Completion of this project will greatly reduce evaporation loss and will provide the Refuge with the capability to divert excess and contaminated drainwater to Stillwater Point Reservoir before it enters the Refuge.

RESOURCE DESCRIPTION AND EXPECTED BENEFITS

LOCATION: Stillwater National Wildlife Refuge
Fallon, Nevada

PROJECT OBJECTIONS: To provide an efficient water delivery system to Stillwater NWR.

NEED FOR THE PROJECT: Under the present system, water delivery is conducted by passing water through the 1,840 acre Stillwater Point Reservoir. This results in the loss of 9,200 acre ft. of water by evaporation annually.

NATURAL RESOURCES: Stillwater National Wildlife Refuge and Management Area provide habitat for up to 350,000 ducks, 13,000 swans, and 10,000 geese during migration periods. Up to 15,000 waterfowl have been produced annually on the Area. Up to 50% of the Pacific Flyway fall canvasback population migrates through Stillwater. Area wetlands serve as a major staging area for over 250,000 shorebirds, including 50% of the long-billed dowitchers population in North America.

PROJECT BENEFITS:

1. Eliminate the loss of over 9,000 acre feet of water annually that results from evaporation by passing water through Stillwater Point Reservoir.

2. Provide the option to divert contaminated water, resulting from petroleum spills at the Fallon Naval Air Station, out of the water delivery system.

3. Eliminate turbidity in the water that is created by passing water through Stillwater Point Reservoir.

4. Reduce leaching of toxic groundwater into nearby Hunter Drain that results from Stillwater Point Reservoir hydrostatic pressures.

RELATIONSHIP TO NORTH AMERICAN WATERFOWL MANAGEMENT PLAN: Stillwater has been nominated as a wetland of international importance under the Convention on Wetlands of International Importance. Lahontan Valley was dedicated as a Western Hemisphere Shorebird Reserve on August 21, 1988; one of only four such sites in the U.S.

PROJECT TIME FRAME: Four months, to be completed with Refuge personnel and equipment.

DURATION OF BENEFITS: Ongoing

CURRENT AND FUTURE TITLE HOLDER AND MANAGER: U.S. Government, U.S. Fish and Wildlife Service.

PUBLIC ACCESS: An average of nearly 7,900 waterfowl hunter visits occur annually on the Area.

WORK PLAN

PROJECT ELEMENTS: A bypass water delivery canal, approximately 12,500 feet in length, will be constructed on the western edge of Stillwater Point Reservoir (see attached map) leading from Diagonal Drain northeasterly to Refuge Structure No. 1. A water control structure would be needed at a point upstream of the confluence of Diagonal Drain and Stillwater Point Reservoir that allows turn-out of water into Stillwater Point Reservoir in the event of flood water or petroleum spills. This work would require engineering and cultural resource surveys to develop the most efficient route.

PROJECT SCHEDULE/ACCOMPLISHMENTS: Engineering and cultural resource surveys -- 1 month canal and structure construction -- 3 months.

PROJECT MONITORING/EVALUATION: To be accomplished by USFWS personnel.

PARTNER RESPONSIBILITIES:

BUDGET

BUDGET OVERVIEW:

BUDGET TABLE:

Line items			Act funds
Operations (direct costs):			
personnel	archaeologist	@ 80 hrs.	1,400
	engineer	@ 80 hrs.	2,050
	(4) equipment operators	@ 960 hrs. ea.	63,000
material/supplies: equipment operating costs (repairs, fuel, maint, etc) in construction of 12,500 feet of canal.			30,000
	Dragline		60,000
	(2) Track excavators		
	dump truck		5,000
contracts: wetlands enhancement - water control structure			50,000
Project mgmt. (indirect costs)			
personnel:	clerk	@ 40 hrs.	350
	contract inspector	@ 120 hrs.	2,200
Total			214,000

PROJECT ELEMENTS:

PROJECT ELEMENTS		ACRES	DOLLARS
ACQUISITION	FEE		$
	EASEMENT		$
	LEASE		$
ENHANCEMENT			$ 214,000.00
RESTORATION			$
OTHER:			$
T O T A L S			$ 214,000.00

GRANTEE: Stillwater National Wildlife Refuge
P.O. Box 1236
Fallon, Nevada 89406-1236

RELIABLE REAL ESTATE COST ESTIMATE CERTIFICATION:

I hereby certify that the estimate of land costs in the proposal, (give title) accurate for the tracts shown:

Tract	Acres	Estimated Cost

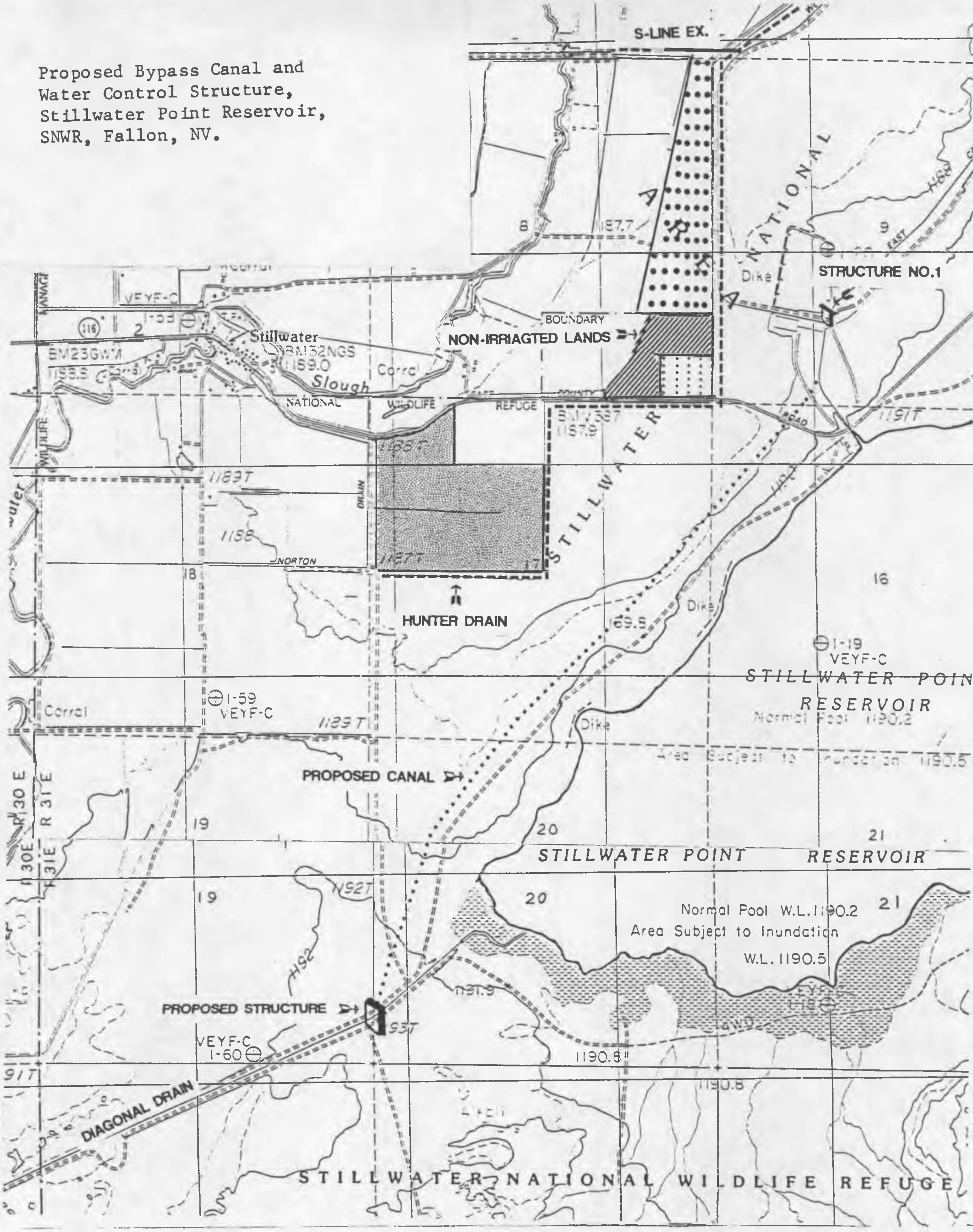
The following procedures were used to determine the land cost estimate:

Ronald M Anglin
Signature

Refuge Manager
Title

6/7/91
Date

Proposed Bypass Canal and
Water Control Structure,
Stillwater Point Reservoir,
SNWR, Fallon, NV.



APPENDIX 4

Stillwater National Wildlife Refuge
P.O. Box 1236
Fallon, Nevada 89406-1236

June 27, 1991

Memorandum

To: Files

From: Wildlife Biologist, Stillwater NWR Bill Henry
Fallon, Nevada

Subject: Field Trip Of Site Of Bypass Canal, Stillwater Point Reservoir (SPR)

On June 25 I conducted an afternoon tour of the proposed bypass canal with the TCID Board members and Bob McDougal (BOR). We discussed the pros and cons of the bypass canal vs. building a dike across SPR.

Negatives:

Size of turnout structure and costs at Diagonal Drain.

Costs for a major bridge/pipe over East County Road.

Costs/time for construction of 60-100 cfs dirt/concrete ditch 12,500 feet in length.

Water quality mix of prime with drain water.

Cost/and size of drop structure at Structure No.1.

Requires 404 permit to build dike in SPR.

Advantages:

Canal: Reduce essentially all drain/seep water to Hunter Drain.

Canal: Quantity/Quality of water significantly increased.

Canal: No costs to rip rap or matting on dike.

Dike: Lower costs/less time to build dike across SPR.

TCID Board preferred a smaller Stillwater Point Reservoir (approximately 1/3 present size) to provide drainwater to Stillwater Farms (until 1998 when Tri-party agreement is terminated).

APPENDIX 5

TRUCKEE—CARSON IRRIGATION DISTRICT

NEWLANDS PROJECT
P.O. BOX 1356
FALLON, NEVADA 89406
TELEPHONE (702) 423-2141

July 17th, 1991

FILE COPY

Ron Anglin, Manager
U.S. Fish & Wildlife
Stillwater Wildlife Management Area
1510 Rio Vista
Fallon, Nevada 89406

Dear Mr. Anglin: Ron

On June 25th Mr. Bill Henry of your staff accompanied the District's Board of Directors on a short tour of the proposed Stillwater Point Reservoir by-pass canal. The diversion of Diagonal Drain flows would occur approximately two miles above the Service's shop facility. The District understands that the estimated cost of that construction is $215,000 as well as a considerable loss of wildlife habitat by virtue of bypassing the reservoir itself.

The District was not in favor of the bypass canal and much prefers an alternative plan whereby the Diagonal Drain flows would continue through Stillwater Point but the size of the reservoir would be reduced by two-thirds. This would save the cost of the by-pass canal ($215,000) and in addition would continue to provide 600-700 acres of wildlife habitat which would otherwise be lost. Additionally, it would provide the District with an alternative means to deliver water to the Stillwater Farms, Inc., beyond the limited potential of the distribution system.

The Board of Directors invites your thoughts in regard to this alternative plan at your earliest convenience. If you would care to discuss the matter further at the August 7th Board meeting, please call for an appointment.

Very truly yours,

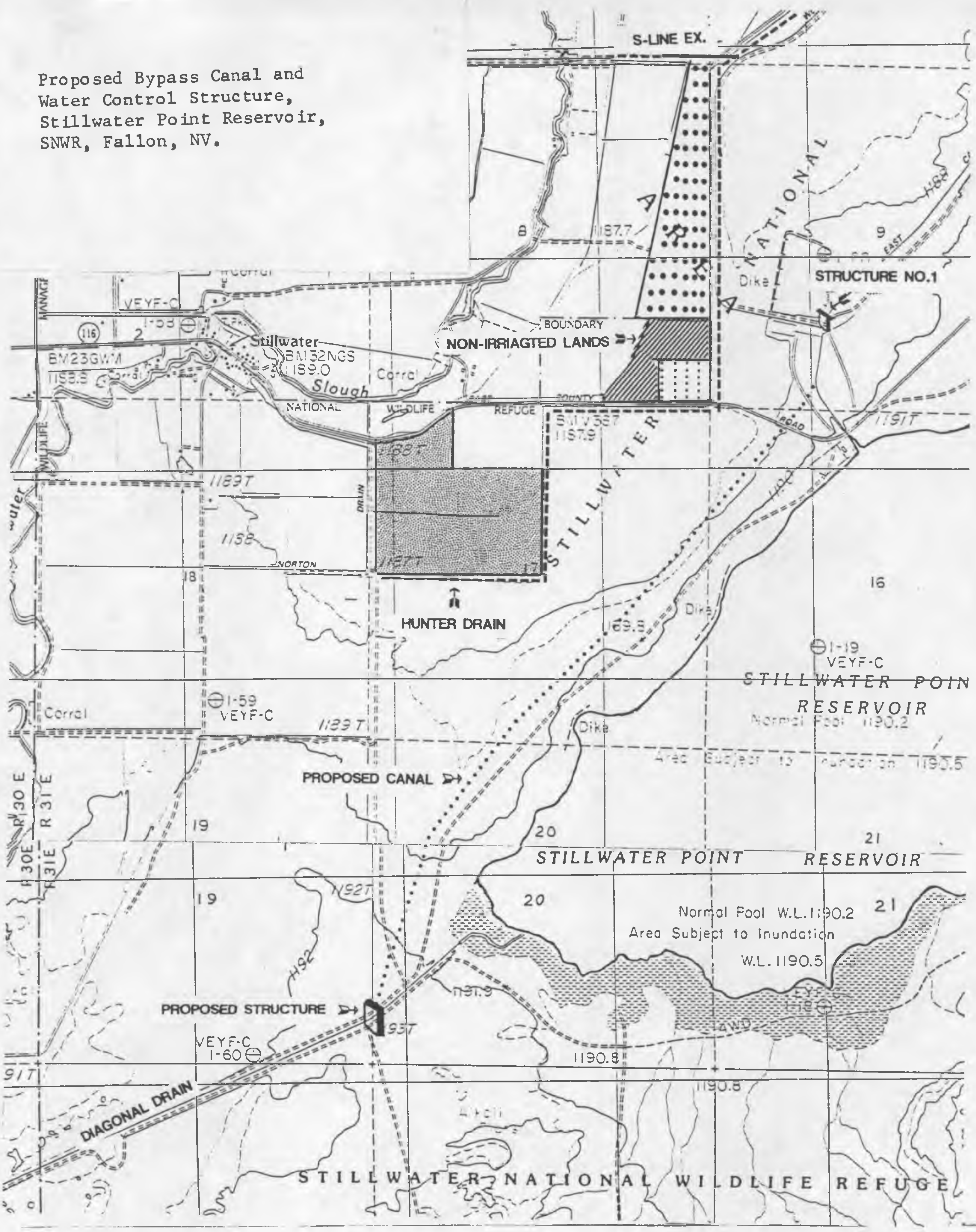
TRUCKEE-CARSON IRRIGATION DISTRICT

Doris Morin

Doris Morin
Secretary-Treasurer

DM/lf

Proposed Bypass Canal and
Water Control Structure,
Stillwater Point Reservoir,
SNWR, Fallon, NV.



Proposal for construction of a bypass delivery canal around Stillwater Point Reservoir, Stillwater NWR, Fallon, Nevada.

Purpose:
To provide the most efficient water delivery system to the eastern portion of the Stillwater NWR. Attempt to reduce or eliminate the hydrostatic pressure leaching toxic groundwater into Hunter Drain.

Introduction:
Stillwater Point Reservoir (SPR) was built in 1944 by the Truckee-Carson Irrigation District (TCID) to store excess drainwater return flows. An outlet structure released water into the Foxtail Flats creating over 3,000 acres of new (non-historical) wetlands.

SPR receives only drainwater from only one source, Diagonal Drain. This accounts for 47 percent of drainwater flows for the Refuge. SPR at full pool totals 1,840 acres with an average evaporation loss of 5 acre feet. This equals 9,200 acre feet lost annually. The present system is extremely inefficient.

Trying to operate SPR as a pass-through system has caused hardship to TCID and Stillwater Farm. Presently, The Stillwater Farm receives water on the east side of their land via SPR. During 1990, a 70 percent irrigation season inflows to SPR exceeded the demand by Stillwater Farm but out flows were significantly reduced due to extensive water spreading and evaporation (Table 1). Also, due to suspended sediments, increased turbidity reduces submergent plant growth in both private and public downstream wetlands.

Currently, Hunter Drain serves 180 acres of irrigated lands and flows 9.2 miles into a small (20 acre) disposal (evaporation) site in Stillwater NWR. This practice was initiated in 1989, in response to documented toxicity problems and tissue residue analysis. Several studies have shown concentrations of drainwater elements and high salinity at acute toxicity levels to three fish and two invertebrate species. Toxicity is believed to be related to a combination of arsenic, boron, lithium and molybdenum.

Proposal:
In order to provide an efficient water delivery system, and reduce groundwater leaching to Hunter Drain, SPR should be abandoned as a pass-through system and only be used to store excess drainwater flows or during flood events.

Refuge water storage would be in the eastern units down gradient in Upper and Lower Foxtail, Dry, Cattail, Doghead and East Alkali Lakes.

These units have greater levels of biological diversity and provide higher bird use days when compared to SPR. Annual aquatic vegetation surveys have shown SPR with very limited submergent and emergent plant growth when compared to the extensive plant growth in and around East Alkali, Doghead, Dry, Cattail and Lower Foxtail units. Fluctuating shallow water levels and high turbidity are contributing factors for the poor plant growth in SPR.

CONSTRUCTION

A bypass canal approximately 12,500 feet in length would be located on the western edge of SPR leading northeasterly to Refuge Structure No. 1. A water control structure (Figure 1) would be needed at a point upstream of the confluence of Diagonal Drain and SPR. A water turn-out is also necessary that would allow emergency releases (flood water or petroleum spills) from entering the Refuge wetlands. This work would require engineering and cultural resource surveys to develop the most efficient canal capacity and route. It is estimated that new canal construction and structure costs would be $200-300K with completion once commenced, in three months.

Table 1. 1990 Stillwater Point Reservoir Flows (70 percent irrigation season).

DATE	GATE	IN FLOW	OUT FLOW	* FLOWS TO STILLWATER FARM
2/28/90	Open	18 CFS	26 CFS	CFS
3/14/90	Open	12	8	
3/21/90	Open	3	3	
3/30/90	Closed	3	0	
4/04/90	Closed	16	0	
4/12/90	Closed	17	0	
4/26/90	Open	18	12	
5/02/90	Closed	22	0	
5/08/90	Open	40	17	
5/17/90	Open	53	16	
5/24/90	Open	42	12	
6/07/90	Open	34	30	15
6/14/90	Open	40	30	15
6/21/90	Open	42	48	15
6/28/90	Open	41	39	
7/05/90	Open	45	37	
7/12/90	Open	43	37	15
7/19/90	Open	56	28	
7/26/90	Open	43	26	
8/01/90	Open	42	25	15
8/08/90	Open	42	25	
8/16/90	Open	43	28	15
8/23/90	Open	42	27	
8/30/90	Open	39	30	15
9/04/90	Open	39	27	15
9/12/90	Open	44	24	15
9/19/90	Open	43	22	
9/26/90	Open	N/A	6	
10/04/90	Open	19	8	
10/11/90	Open	13	6	
10/17/90	Open	14	8	8
10/24/90	Open	62	31	16
10/31/90	Open	35	40	17
11/07/90	Open	22	12	
11/15/90	Open	22	17	
11/21/90	Open	17	12	
11/29/90	Open	16	11	
12/05/90	Open	13	9	
		1,165	710	Deficit <455> CFS
12/12/90	Closed Reservoir Frozen			

* Total receipts to Stillwater Farm lacking.